Stoller
Grand Junction Office established 1959

GJO-2004-584-TAC

C4209
Log Data Report

Borehole Information:

Borehole: C4209			**Site:** 216-U-1 and -2 Cribs		
Coordinates (WA State Plane)		**GWL (ft)[1]:** Dry		**GWL Date:**	02/06/2004
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
Not Available	Not Available	Feb. 2004	Not Available	50	Push Hole

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	0.1	6 5/8	5 1/2	9/16	0.1	48.83

Borehole Notes:

The logging engineer measured a sample of casing located in a lay-down area next to the borehole. Casing diameter was measured using a caliper and a steel tape, and measurements were rounded to the nearest 1/16 in.

Logging Equipment Information:

Logging System:	Gamma 1E		**Type:**	SGLS (70%) 34TP40587A
Calibration Date:	01/2004	**Calibration Reference:**	GJO-2004-568-TAC	
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3 Repeat		
Date	02/06/04	02/06/04	02/06/04		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	48.83	48.5	12.5		
Finish Depth (ft)	48.83	0.5	7.5		
Count Time (sec)	100	100	100		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A[3]	N/A	N/A		
Pre-Verification	AE078CAB	AE078CAB	AE078CAB		
Start File	AE078000	AE078001	AE078050		
Finish File	AE078000	AE078049	AE078055		
Post-Verification	AE079CAA	AE079CAA	AE079CAA		
Depth Return Error (in.)	N/A	0	0		

Log Run	1	2	3 Repeat		
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.		

Logging Operation Notes:

Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. Logging started (log run 1) with the sonde tip at the bottom of the borehole at a logging depth of 48.83 ft. The sonde was then raised to the nearest 0.5-ft interval (48.5 ft) above total depth to continue with the logging (log run 2). Zero reference is the ground surface.

Analysis Notes:

Analyst:	Henwood	Date:	02/08/04	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the acceptance criteria. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G1EJan04.xls). Zero reference was the ground surface. Based on the field measurements, the casing configuration was assumed as one string of 6-in. casing with a thickness of 9/16 in. to 48.83 ft (total logging depth). The dead time correction is applied when the dead time exceeds 10 percent; no dead time correction was needed. A water correction was not required.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs was the man-made radionuclide detected in this borehole. ^{137}Cs was detected from 0.5 to 16.5 ft with concentrations ranging from approximately 0.2 to 43 pCi/g. The maximum concentration was measured at 3.5 ft.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides at energy levels of 1461, 1764, and 2614 keV and ^{137}Cs at 662 keV.

[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable

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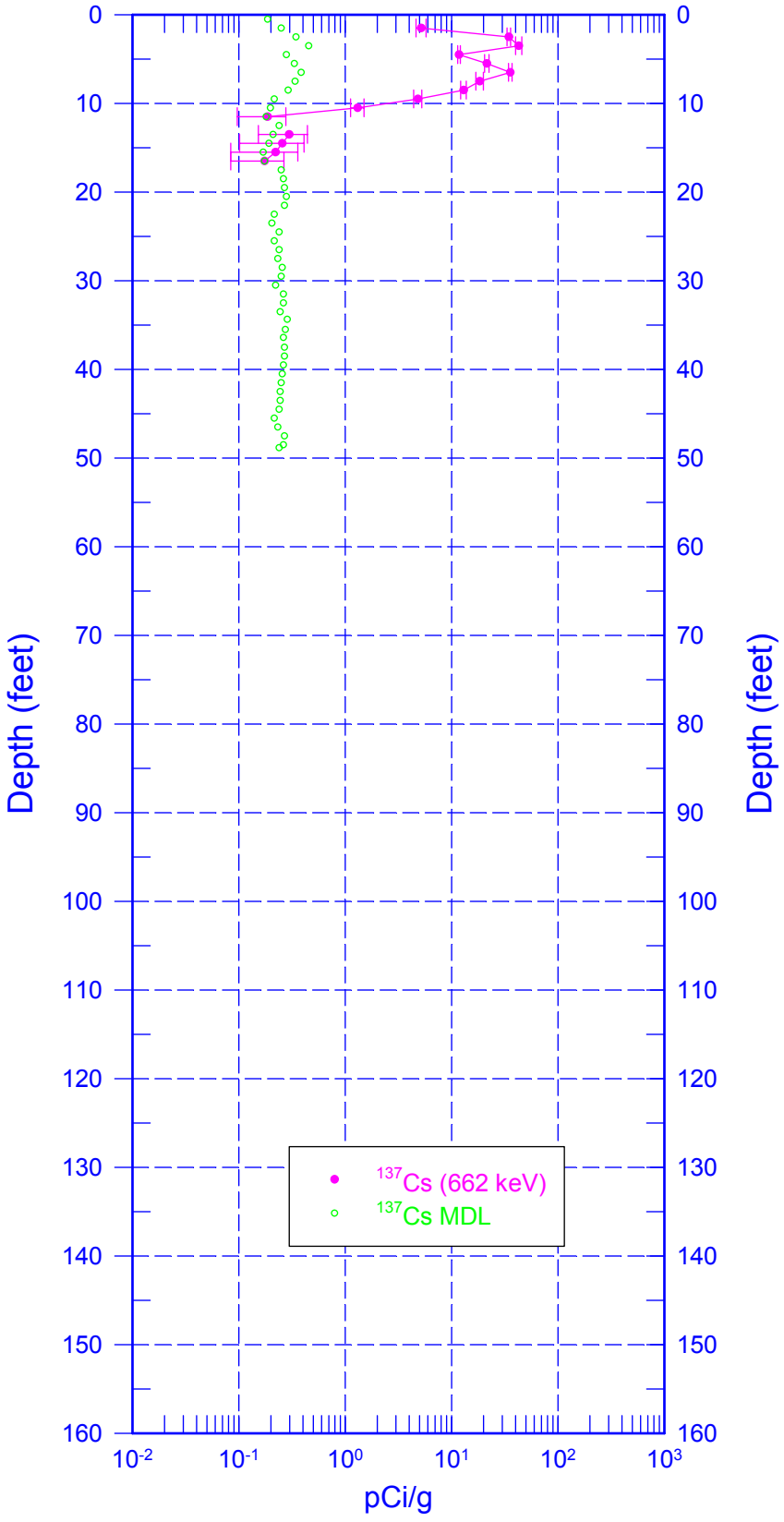
Man-Made Radionuclides



Zero Reference = Ground Surface

Depth Scale: 1"=20 ft

Last Log Date - 02/06/04

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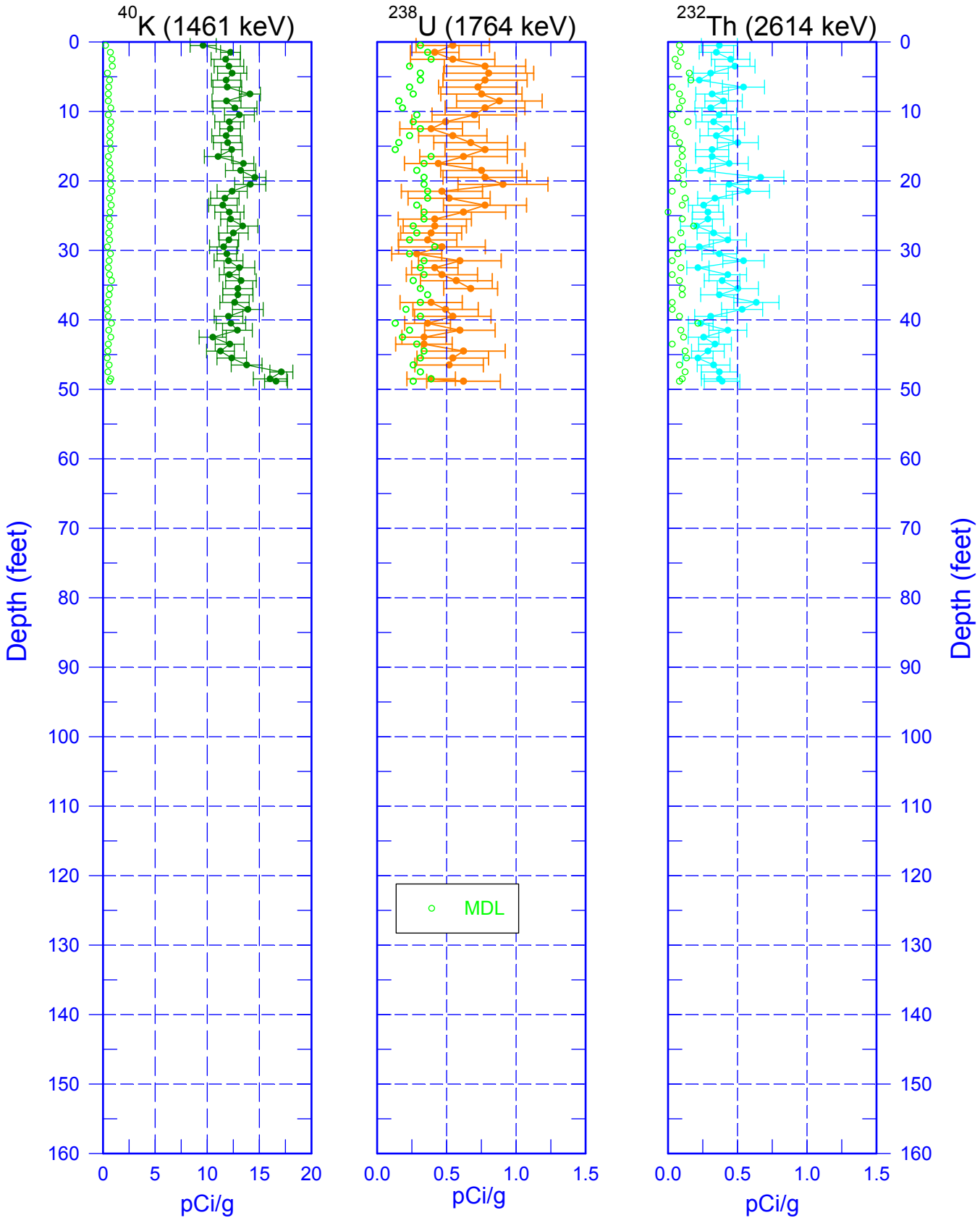
Natural Gamma Logs

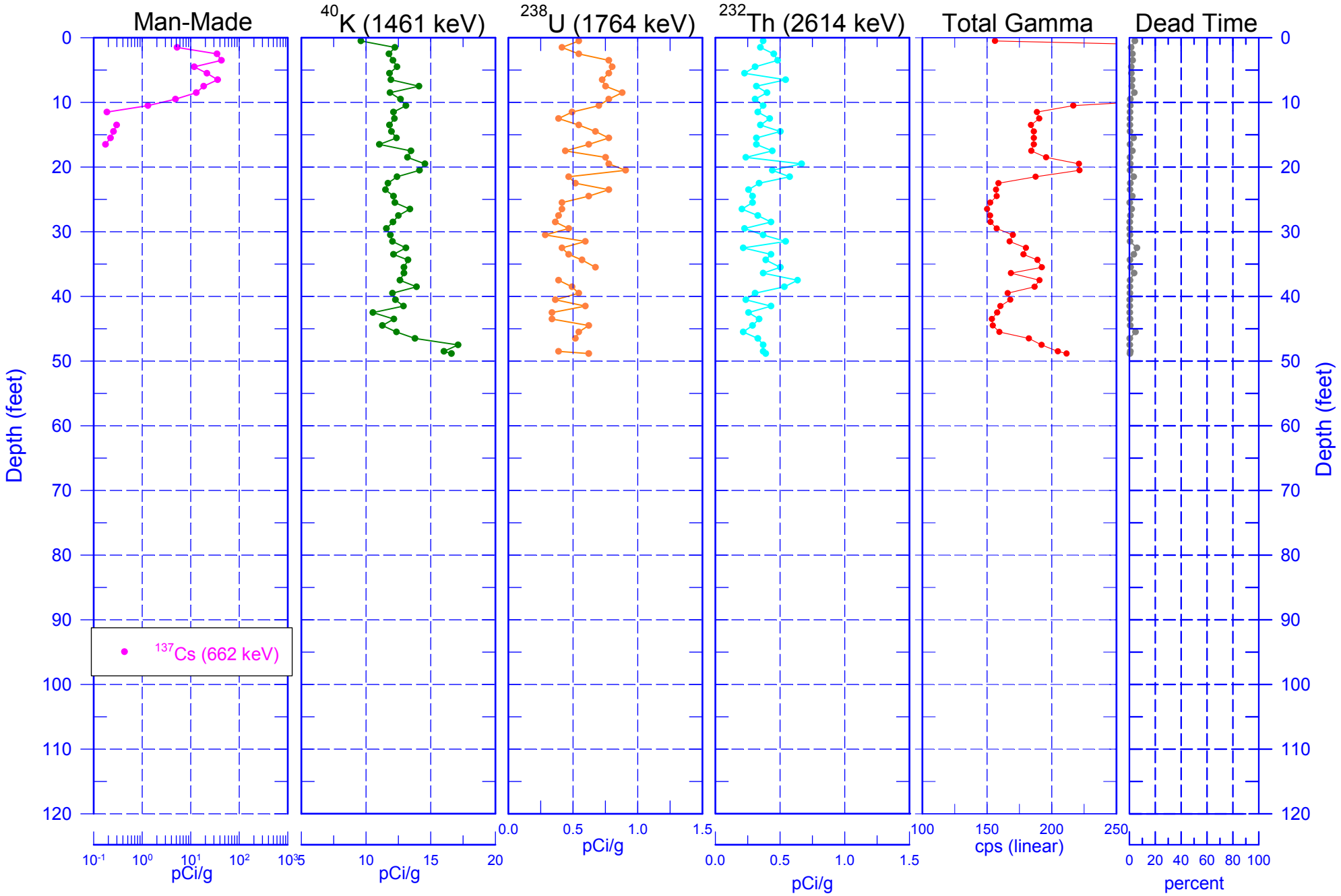


Zero Reference = Ground Surface

Depth scale: 1" = 20 ft

Last Log Date - 02/06/04

C4209 Combination Plot

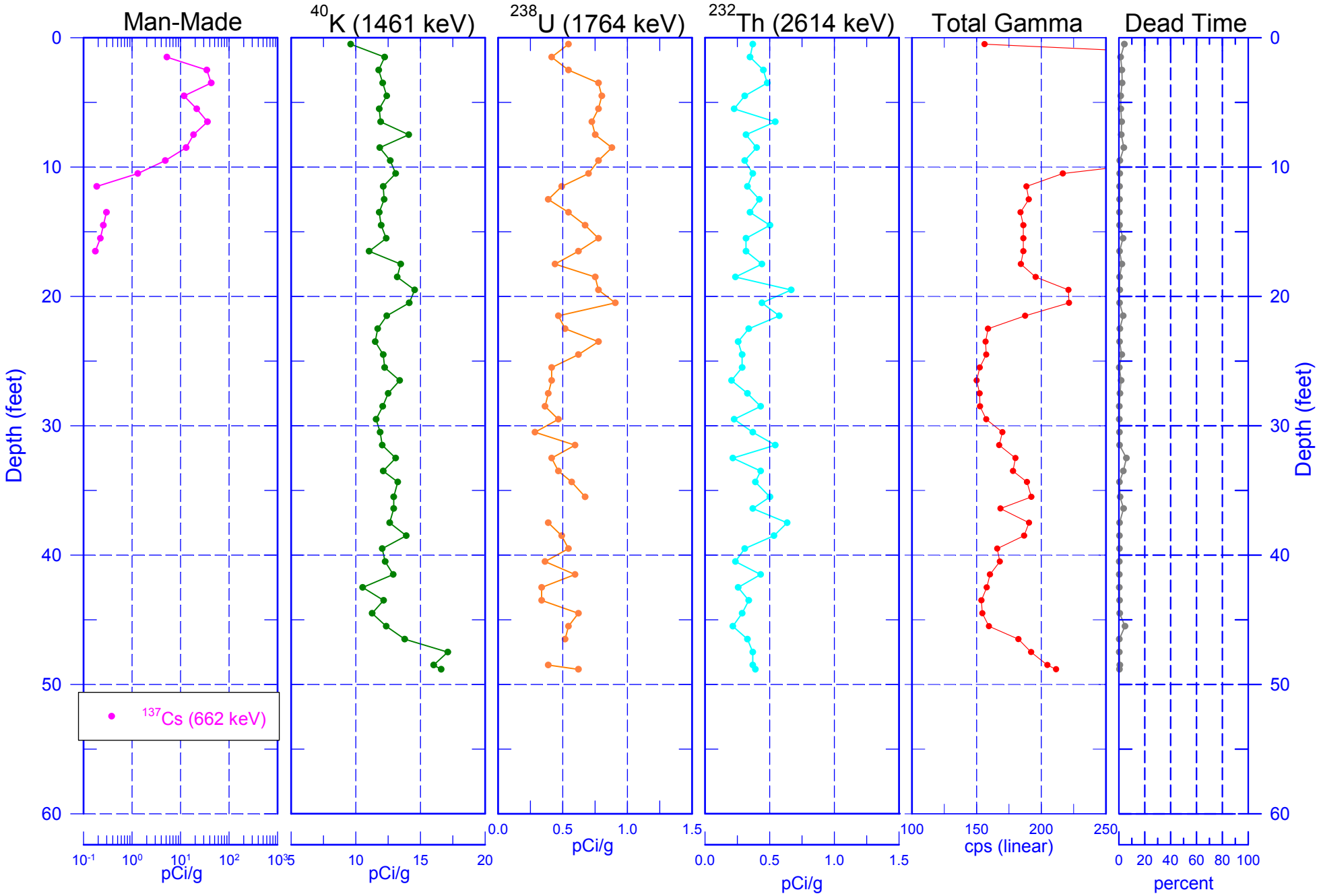


Zero Reference = Ground Surface

Depth scale: 1"=20 ft

Last Logging Date - 02/06/04

C4209 Combination Plot



Zero Reference = Ground Surface

Depth scale: 1"= 10 ft

Last Logging Date - 02/06/04

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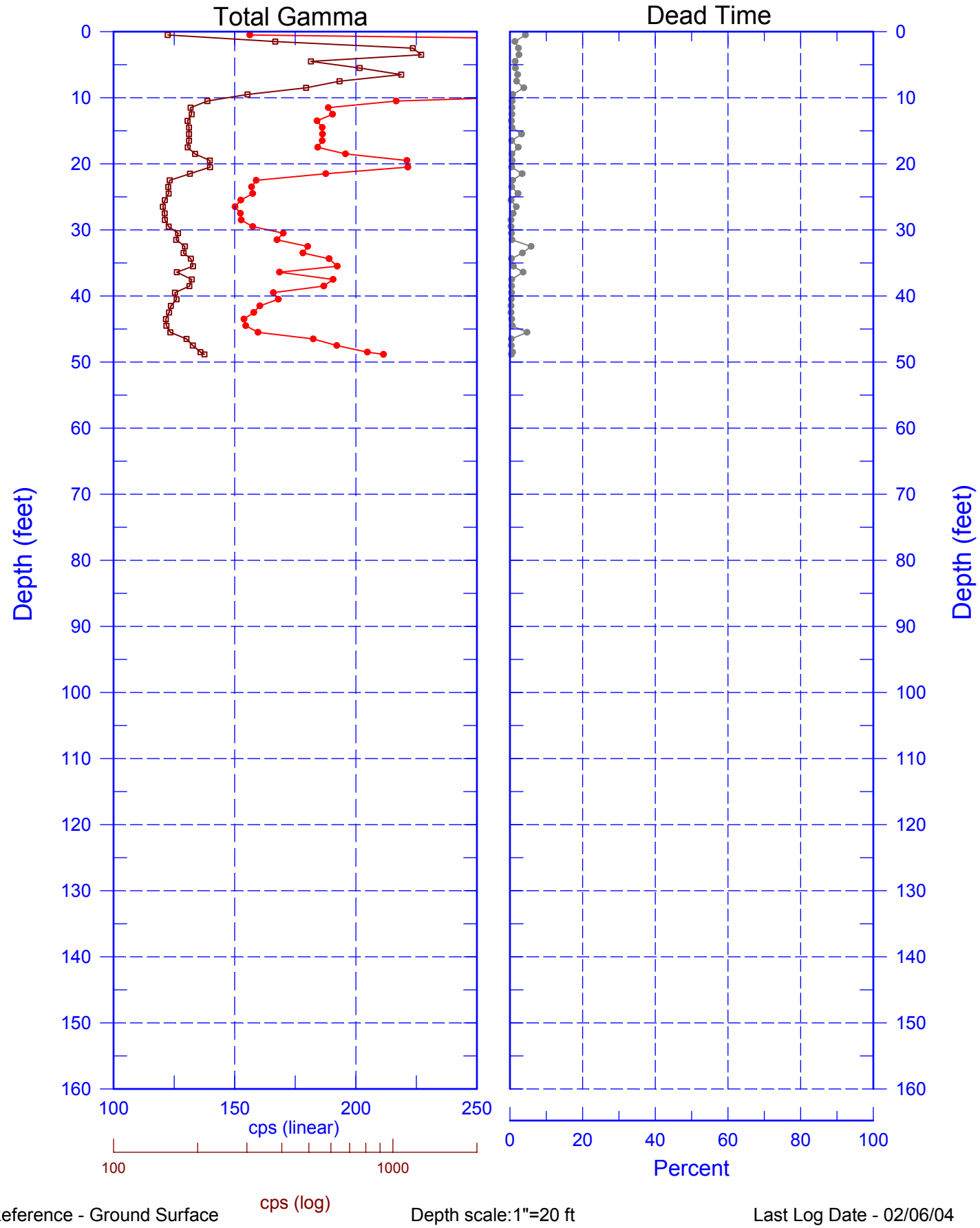
Total Gamma & Dead Time



Reference - Ground Surface

Depth scale:1"=20 ft

Last Log Date - 02/06/04

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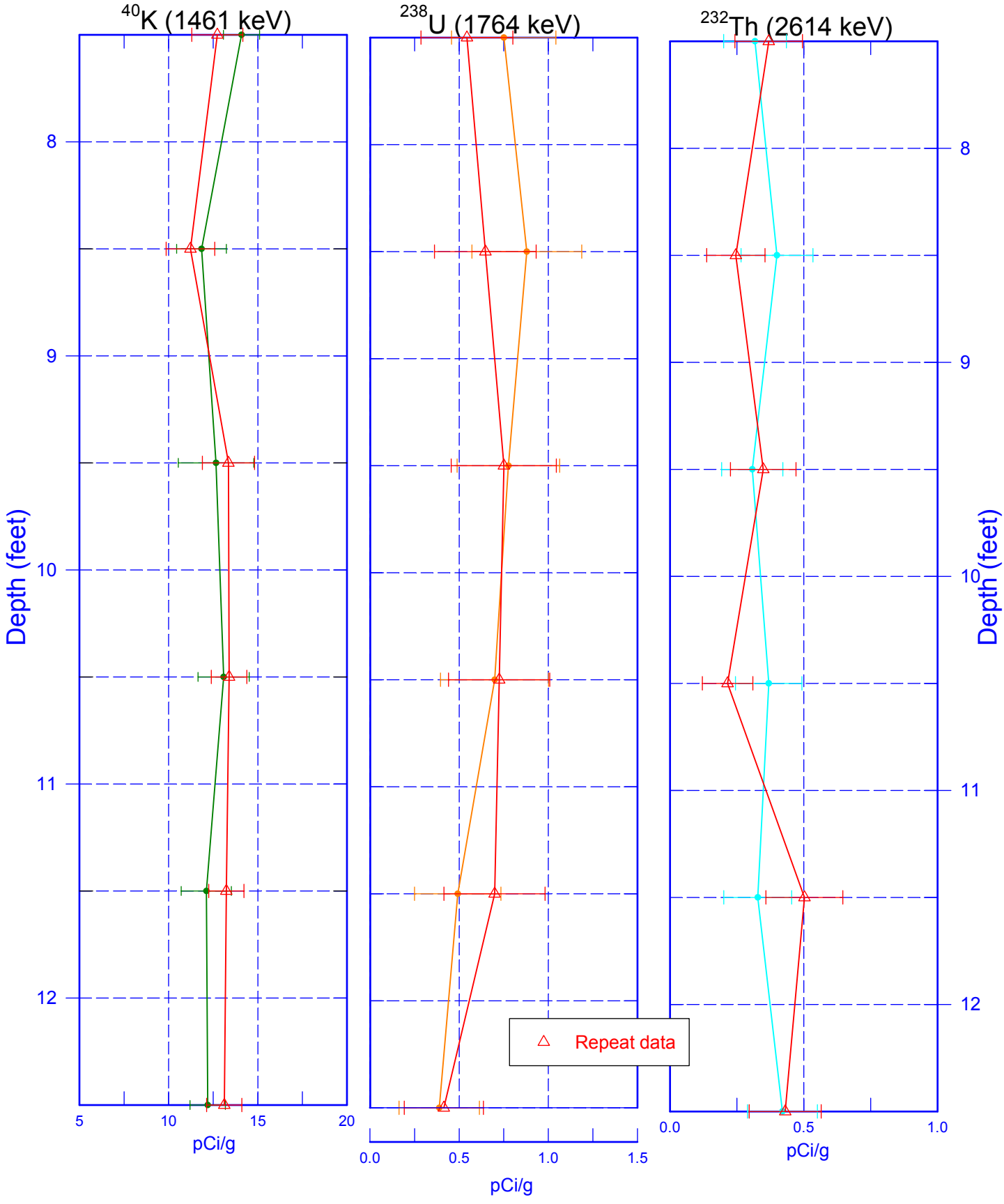
Repeat Section of Natural Gamma Logs



Zero Reference = Ground Surface

Last Log Date - 02/06/04